



Rewarding Learning

General Certificate of Secondary Education  
2017–2018

Centre Number

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Candidate Number

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## Double Award Science: Physics

Unit P1  
Higher Tier

**MV18**

[GSD32]

FRIDAY 10 NOVEMBER 2017, MORNING

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### Time

1 hour, plus your additional time allowance.

### Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.  
Answer **all nine** questions.

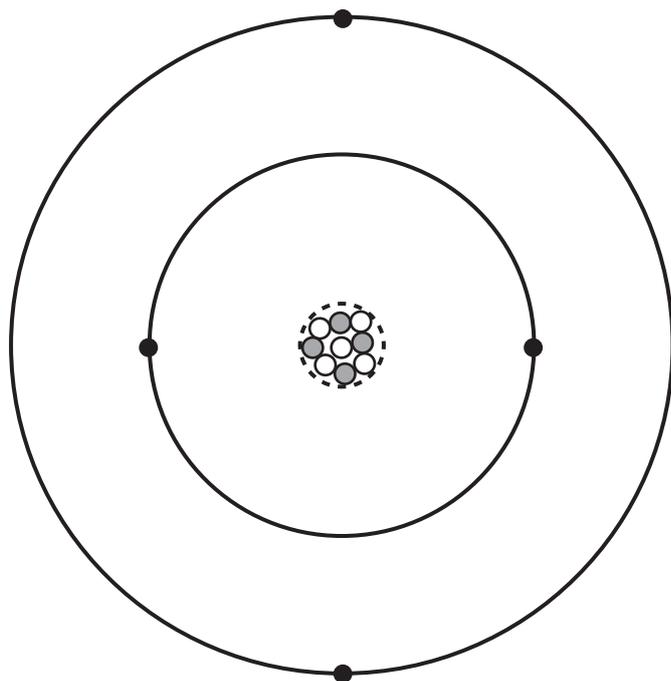
### Information for Candidates

The total mark for this paper is 70.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **2** and **7**.

1 A neutral atom is represented by the diagram below.



Some information about the atom is given in the table below.

(a) Complete the table. [6 marks]

Particle	Name	Relative mass	Relative charge
●		$\frac{1}{1840}$	
●			+1
○	neutron		

When a substance is radioactive it will emit ionising radiation.

**(b)** What do you understand by 'ionisation'? [2 marks]

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**(c)** A radioactive substance has a half-life of 4 minutes. There are 8000 undecayed nuclei present now. How many undecayed nuclei will remain after 12 minutes? [3 marks]

**You are advised to show your working out.**

Number of undecayed nuclei = \_\_\_\_\_



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**(Questions continue overleaf)**

- 3 An object accelerates from rest for a time,  $t$ . During the acceleration it travels a distance,  $d$ .

It is suggested that the distance,  $d$  and the time,  $t$  are related by the equation:

$$d = kt^2 \qquad \text{Equation 3.1}$$

where  $k$  is a constant.

An engineer obtains the following results in an investigation.

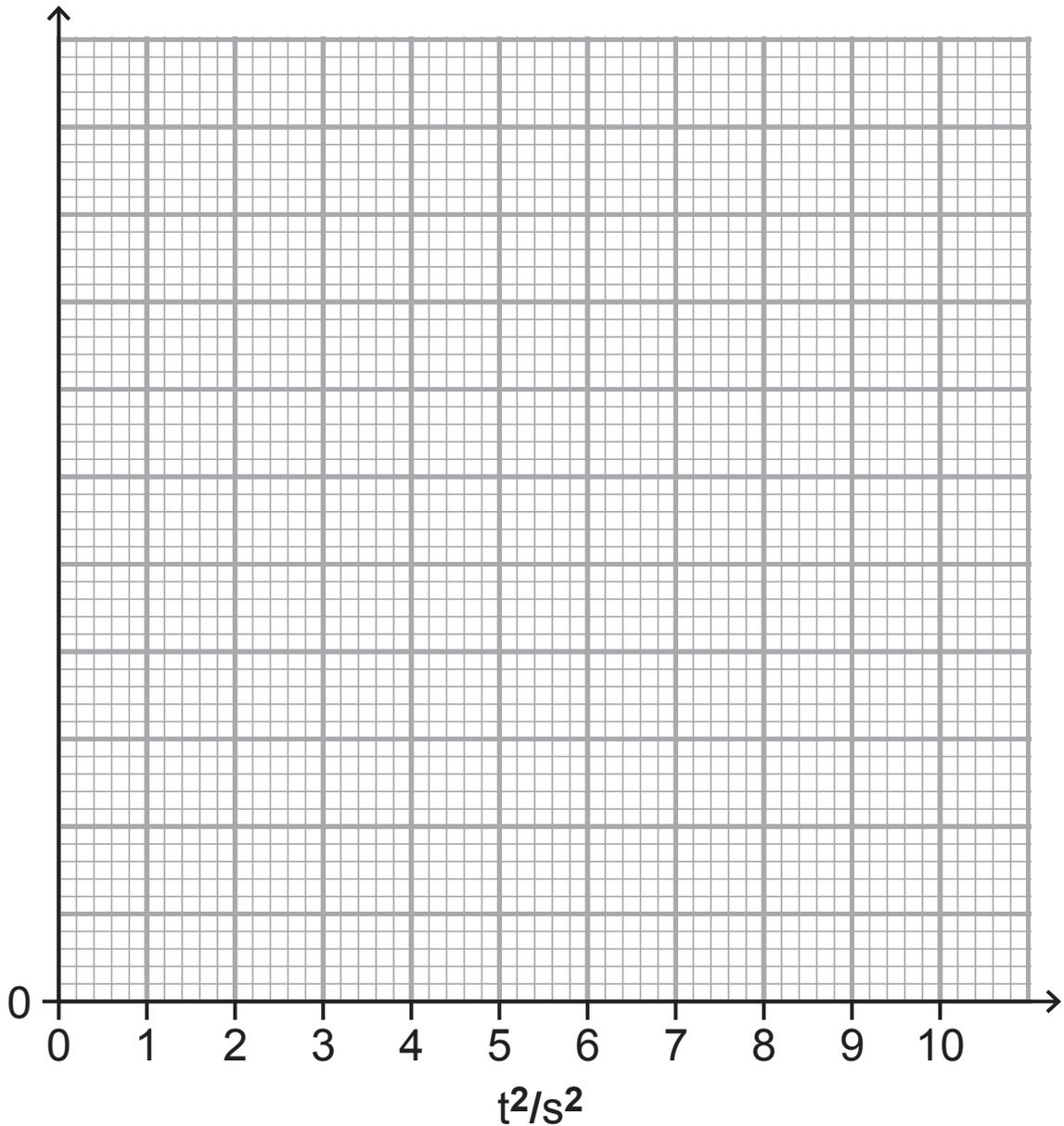
$d/m$	0	2	8	18	20
$t^2/s^2$	0	1	4	9	10

You are asked to plot a graph of  $d$  (vertical axis) against  $t^2$  (horizontal axis).

- (a) Choose a suitable vertical scale and label it.  
[2 marks]

- (b) Plot a graph of  $d$  against  $t^2$ . [2 marks]

(c) Draw the straight line of best fit. [1 mark]



(d) (i) Use your graph to state the relationship, in words, between distance ( $d$ ) and time<sup>2</sup> ( $t^2$ ). [1 mark]

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(ii) Explain how your graph shows this. [2 marks]

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(iii) Calculate the gradient of your line and give its unit.  
[3 marks]

**You are advised to show your working out.**

Gradient = \_\_\_\_\_

Unit = \_\_\_\_\_

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**(Questions continue overleaf)**

- 4 (a) The mass of a lorry and its fuel is 2200 kg. Their total momentum is 39 600 kg m/s.  
Calculate the velocity of the lorry. [3 marks]  
**You are advised to show your working out.**

Velocity = \_\_\_\_\_ m/s

- (b) The lorry is driven with an acceleration of 2 m/s<sup>2</sup>.

- (i) Calculate the resultant force on the lorry.  
Remember the mass of the lorry and its fuel is 2200 kg. [3 marks]  
**You are advised to show your working out.**

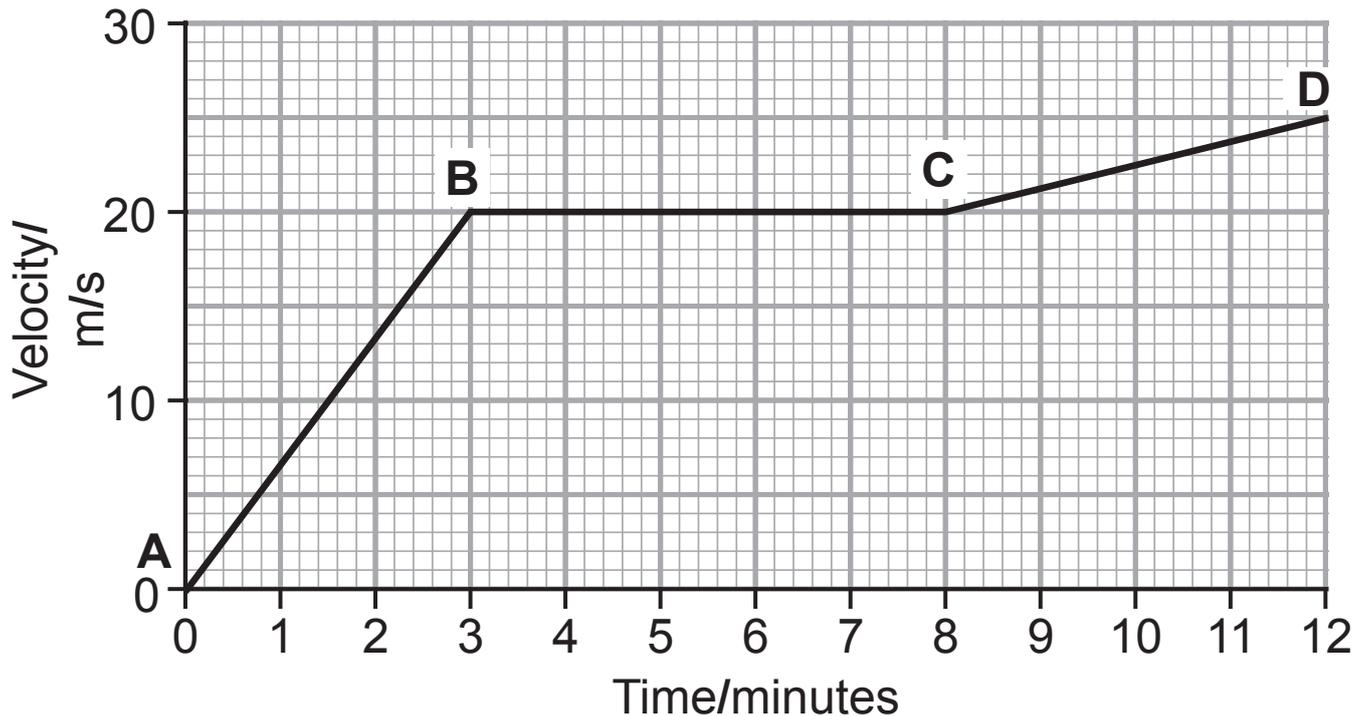
Resultant force = \_\_\_\_\_ N

Much later in the journey the **same resultant force** causes the lorry to move with an acceleration of  $2.2 \text{ m/s}^2$ .

- (ii) Calculate the mass of fuel consumed. [3 marks]  
**You are advised to show your working out.**

Mass of fuel consumed = \_\_\_\_\_ kg

5 The velocity–time graph for a train journey is shown.



(a) The graph has three regions AB, BC and CD. For **each region** tick (✓) the box which describes the motion of the train. [3 marks]

AB    Increasing acceleration   

Zero acceleration   

Constant acceleration

- |    |                         |                          |
|----|-------------------------|--------------------------|
| BC | Increasing acceleration | <input type="checkbox"/> |
|    | Zero acceleration       | <input type="checkbox"/> |
|    | Constant acceleration   | <input type="checkbox"/> |
| CD | Increasing acceleration | <input type="checkbox"/> |
|    | Zero acceleration       | <input type="checkbox"/> |
|    | Constant acceleration   | <input type="checkbox"/> |

**(b)** Find the distance travelled by the train in the first **3 minutes** of its journey. [4 marks]

**You are advised to show your working out.**

Distance travelled = \_\_\_\_\_ m

6 A crane lifts a steel beam.



The crane's power output is 0.5 kW and it lifts the beam in a time of 150 seconds.

(i) Calculate the work done on the beam. [4 marks]

**You are advised to show your working out.**

Work done = \_\_\_\_\_ J

- (ii) State the increase in potential energy of the beam.  
[1 mark]

Increase in potential energy = \_\_\_\_\_ J

- (iii) On another occasion a different beam is lifted and the crane's output energy is 50 000 J. If the crane's efficiency is 0.4 calculate its input energy. [3 marks]

**You are advised to show your working out.**

Input energy = \_\_\_\_\_ J

7 Solids, liquids and gases are the three states of matter.

Describe the **arrangement** and **motion** of the particles in each of these three states. [6 marks]

**You will be assessed on your written communication skills including the use of specialist scientific terms.**

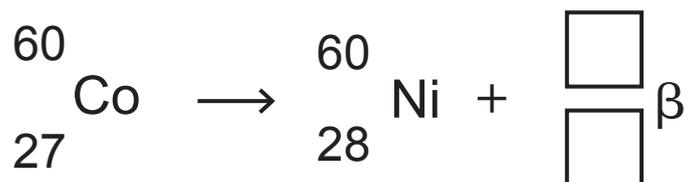
Solid \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Liquid \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Gas \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

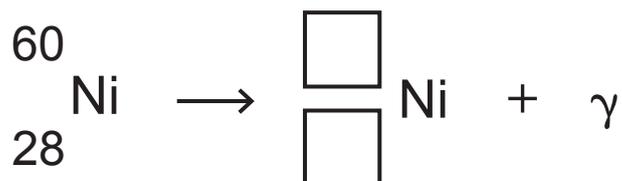
8 Cobalt-60 emits a beta particle to become nickel.

(i) Complete the boxes in the equation below. [2 marks]



The nickel nucleus is still unstable and emits gamma radiation.

(ii) Complete the boxes in the equation below. [2 marks]

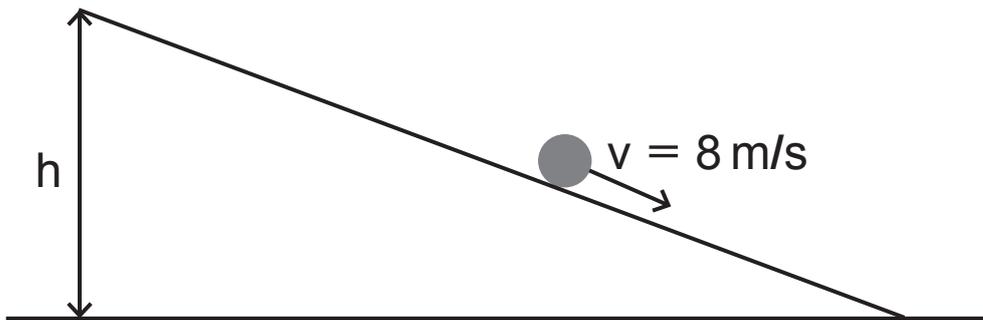


- 9 (a) State the Law of Conservation of Energy. [1 mark]

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- (b) A boulder of mass 120 kg rolls down a slope from rest.



At the point shown the velocity of the boulder is 8 m/s and its potential energy is 4560 J.

- (i) Calculate the kinetic energy of the boulder at this point and use your answer to find the boulder's total energy. [4 marks]

**You are advised to show your working out.**

Total energy = \_\_\_\_\_ J

- (ii) Use the law of Conservation of Energy to calculate the initial height,  $h$  of the boulder. Assume no energy losses. [3 marks]

**You are advised to show your working out.**

Height,  $h =$  \_\_\_\_\_ m

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**THIS IS THE END OF THE QUESTION PAPER**

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## SOURCES

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>Total Marks</b>	

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